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## SOME FEATURES IN ARTESIAN WELL CONSTRUCTION IN MANKATO<sup>1</sup>

By H. F. BLOMQUIST

Mankato is located in the artesian basin of Minnesota, being in the southwestern part of it, and a number of artesian wells have been sunk in the city. The first was sunk in 1888. One of the deepest wells in the United States is located only  $1\frac{1}{2}$  miles from here. The hills around Mankato are about 230 feet above the street level and the city wanted a well upon the top of one of these hills, called Bunker Hill, one of the highest in the city. A well was drilled about 2204 feet deep and was at that time one of the deepest, if not the deepest, in this country. The water rose within about 40 feet from the surface. That would bring the water approximately 175 feet above the elevation of the business section of the city. It was intended to run that water into a reservoir but the plan did not work out as well as anticipated. The city spent \$12,000 in the experiment but the well has never been used. An artesian well was sunk in this city about two years ago that is 1452 feet deep.

One of the first wells that was drilled was about 365 feet deep. Two others were sunk about 665 feet each and gave the required supply of water. In 1900 one of those wells was deepened to 1365 feet to increase the flow of that well. The flow then was over 600 gallons a minute, flowing at the surface of the ground. That was sufficient until more wells were dug, particularly one by the Hubbard Milling Company. The one deepened to 1365 feet was again deepened last summer to 1450 feet, and given an iron casing to a depth of 220 feet. Steel casing lasts about twelve or fifteen years. It has been necessary to replace the casings of two wells within the last three years. A bad feature is that when the casing starts to leak it is necessary to put in a smaller casing, thereby reducing the size of the well. In the last well that was built, a cast iron casing was used. A 16-inch hole was drilled and a 15-inch pipe was lowered about 90 feet. A 15-inch hole was continued to 156 feet. Cast iron pipe

<sup>1</sup>Abstract of a paper read before the Minnesota Section, November 10, 1917.

was made expressly for this well, threaded at the ends and coupled together with brass couplings, and it is hoped the well will stand about fifty years more.

The water here contains a certain amount of substances that are not wanted and some kind of purification is desirable. There are some peculiarities in the water not found in the ordinary well supplies. The artesian water comes from the depths where the pressure is very high, and since water under high pressure holds substances in solution which would otherwise be in solid form, the water of Mankato contains matter in solution which is afterwards precipitated when the pressure is relieved. Evidence of this is often seen when water is drawn from a faucet into a glass. The water containing carbon dioxide in solution under pressure holds iron and sulphur compounds in solution, which, when the pressure is relieved and the water comes into contact with air, undergo chemical reactions which change the iron compound to ferric hydroxide which precipitates into a brown substance, and is so often seen when water is allowed to run slowly over a light colored surface. The sulphur is given off in the form of hydrogen sulphide, which has the peculiar odor that is responsible for the erroneous assumptions of some consumers that the water has become stagnant in the mains. The carbon dioxide is also given off when the pressure is relieved, and being a gas it forms in small particles and gives to the water a milky or turbid appearance often seen when filling a glass, but which soon passes off leaving the water clear. Because of this quality of the water it is necessary to flush the water mains very often.